

Section 8-9

Binomial Probabilities

Warm-up

1. Write all the possible permutations of heads and tails when a coin is tossed three times.

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HHH, HHT, HTH, HTT, THH, THT, TTH,
TTT

Warm-up

2. If the probability of heads is .6, find the probability of each outcome in question 1.

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THH=

HHT=

THT=

HTH=

TTH=

HTT=

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Warm-up

2. If the probability of heads is .6, find the probability of each outcome in question 1.

$$HHH = (.6)^3$$

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$$TTH =$$

$$HTT =$$

$$TTT =$$

Warm-up

2. If the probability of heads is .6, find the probability of each outcome in question 1.

$$HHH = (.6)^3 = .216$$

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Warm-up

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$$HHT = .6^2 \cdot .4$$

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Warm-up

2. If the probability of heads is .6, find the probability of each outcome in question 1.

$$HHH = (.6)^3 = .216$$

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$$HHT = .6^2 \cdot .4 = .144$$

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2. Two possible outcomes: Success (S) and Failure (F)
3. Independent trials
4. Each trial has the same probability of success
5. There are a fixed number of trials

Example 1

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- a. What is the probability of getting exactly two sums of 7 in 5 tosses?

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$$P(S) = \frac{1}{6} \qquad P(F) = \frac{5}{6}$$

$$P(\text{exactly 2 sums of 7}) = 10 \left(\frac{1}{6}\right)^2 \left(\frac{5}{6}\right)^3$$

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$$P(\text{exactly 2 sums of 7}) = 10 \left(\frac{1}{6}\right)^2 \left(\frac{5}{6}\right)^3 \approx .1607510288$$

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$$= 10\left(\frac{1}{6}\right)^2 \left(\frac{5}{6}\right)^3 + 10\left(\frac{1}{6}\right)^3 \left(\frac{5}{6}\right)^2 + 5\left(\frac{1}{6}\right)^4 \left(\frac{5}{6}\right) + \left(\frac{1}{6}\right)^5$$

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$$\approx .196244856$$

Binomial Probability Theorem

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In a binomial experiment with n trials, a probability of success p in each trial, and a probability of failure of q ($q = 1 - p$):

$$P(\text{exactly } k \text{ successes}) = {}_n C_k \cdot p^k q^{n-k}$$

Example 2

What is the probability of getting at least 8 of 10 questions on a test correct, if you feel you have an 80% chance of answering each individual question correctly?

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$${}_{10}C_8(.8)^8(.2)^2 + {}_{10}C_9(.8)^9(.2) + {}_{10}C_{10}(.8)^{10} \\ \approx .6777995264$$

Binomial Probability Distribution

The probability distribution that is generated from a binomial experiment

Example 3

Determine the probability distribution from the binomial experiment in example 1.

Let x be the number of sums of 7 in 5 tosses of the two dice.

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$$\text{When } x = 0: \left(\frac{5}{6}\right)^5 \approx .401877572$$

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Determine the probability distribution from the binomial experiment in example 1.

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When $x = 1$:

Example 3

Determine the probability distribution from the binomial experiment in example 1.

Let x be the number of sums of 7 in 5 tosses of the two dice.

$$\text{When } x = 0: \left(\frac{5}{6}\right)^5 \approx .401877572$$

$$\text{When } x = 1: 5\left(\frac{5}{6}\right)^4 \left(\frac{1}{6}\right)$$

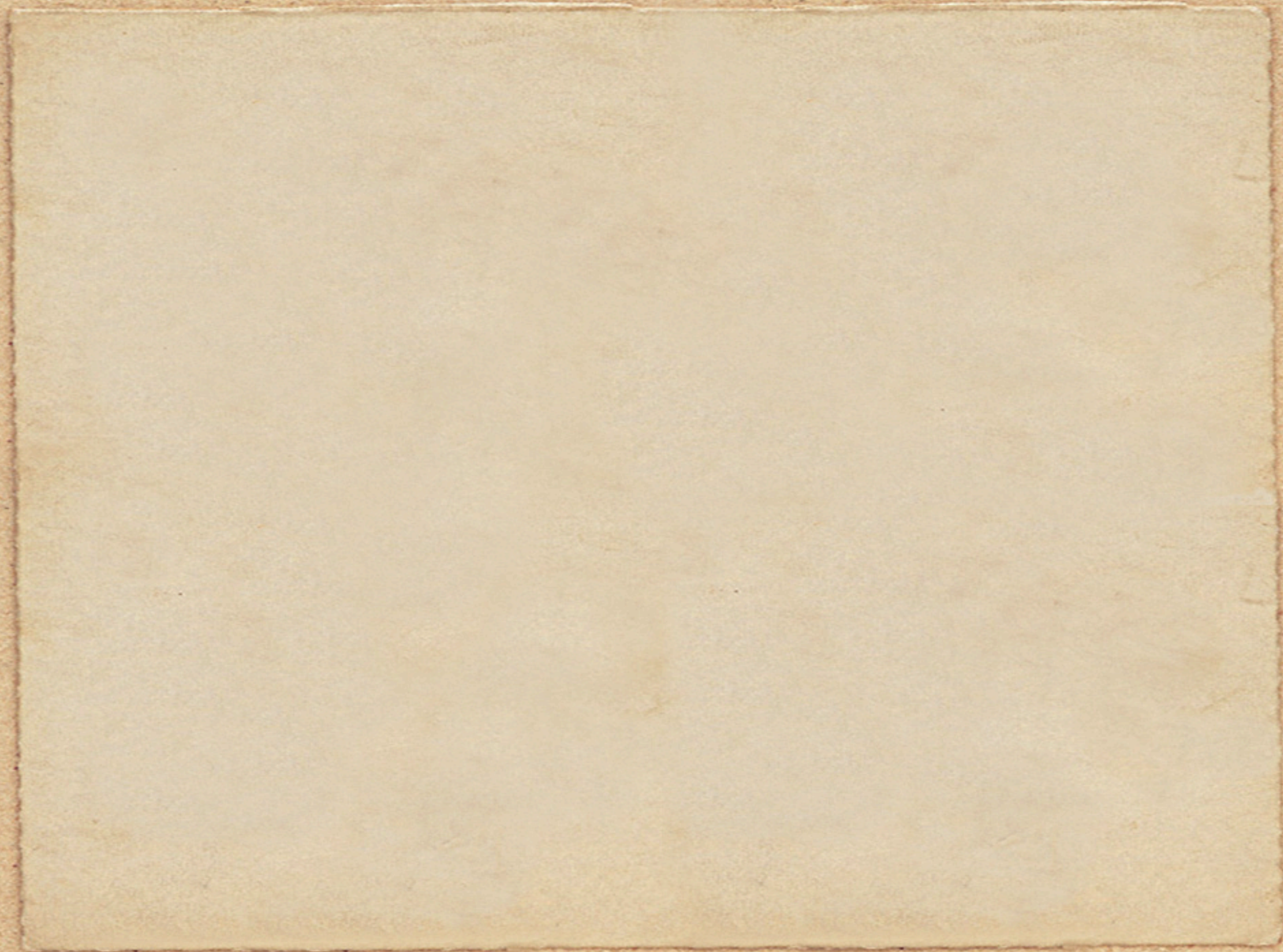
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Let x be the number of sums of 7 in 5 tosses of the two dice.

$$\text{When } x = 0: \left(\frac{5}{6}\right)^5 \approx .401877572$$

$$\text{When } x = 1: 5\left(\frac{5}{6}\right)^4 \left(\frac{1}{6}\right) \approx .4018775772$$



When $x = 2$:

When $x = 2$: $10\left(\frac{5}{6}\right)^3 \left(\frac{1}{6}\right)^2 \approx .1607510288$

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$$\text{When } x = 3: 10\left(\frac{5}{6}\right)^2 \left(\frac{1}{6}\right)^3 \approx .0321502058$$

$$\text{When } x = 2: 10\left(\frac{5}{6}\right)^3 \left(\frac{1}{6}\right)^2 \approx .1607510288$$

$$\text{When } x = 3: 10\left(\frac{5}{6}\right)^2 \left(\frac{1}{6}\right)^3 \approx .0321502058$$

$$\text{When } x = 4: 5\left(\frac{5}{6}\right)\left(\frac{1}{6}\right)^4 \approx .0032150206$$

$$\text{When } x = 2: 10\left(\frac{5}{6}\right)^3 \left(\frac{1}{6}\right)^2 \approx .1607510288$$

$$\text{When } x = 3: 10\left(\frac{5}{6}\right)^2 \left(\frac{1}{6}\right)^3 \approx .0321502058$$

$$\text{When } x = 4: 5\left(\frac{5}{6}\right)\left(\frac{1}{6}\right)^4 \approx .0032150206$$

$$\text{When } x = 5: \left(\frac{1}{6}\right)^5 \approx .000128600823$$

Sums of 7	P(Sums of 7)
0	0.401877572
1	0.401877572
2	0.1607510288
3	0.0321502058
4	0.0032150206
5	0.000128600823

Homework

Homework

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